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APE 1236 DEACTIVATION FURNACE UPGRADE TO MEET RCRA REQUIREMENTS

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APE 1236 DEACTIVATION FURNACE UPGRADE TO MEET RCRA REQUIREMENTS

ABSTRACT

This paper is a comprehensive review of the current status of the upgrade of the APE 1236 furnaces and Explosive Waste Incinerators (EWI) to meet the RCRA regulations. It includes a description of the equipment and the purpose of each component. It also contains an overview of permitting issues and the outlook for burning munitions in an environment of changing regulations.

INTRODUCTION

In 1978 Congress passed environmental legislation known as the Resource Conservation and Recovery Act or RCRA. This law regulates the processing, handling, transportation, storage and disposal of hazardous waste. The APE 1236 furnaces are used to dispose of class 1.1, 1.2, and 1.3 munitions which are classified as hazardous waste. The furnace must therefore be permitted as a hazardous waste incinerator when these types of munitions are burned.

BACKGROUND

A project was initiated in 1987 to upgrade the APE 1236 furnaces to comply with RCRA standards for burning hazardous waste. The project included design, purchase, and installation of equipment which would bring the furnaces into compliance with RCRA hazardous waste incineration (HWI) regulations so a RCRA part B permit could be obtained. The part B permit defines the conditions under which the sites will be permitted to operate.

PROJECT STATUS

The original APE 1236 furnace consists of a rotary retort 20 feet long and 3 feet in diameter made up of 4 sections, each 5 feet in length. The two end sections are made of cast steel 2-3/4 inches in thickness and the two center sections are 3-1/2 inches in thickness. The sections have an internal spiral flight which is an integral part of the casting that pushes the material being burned through the furnace as the retort sections rotate. The flights vary in height with the highest section in the middle, tapering down toward both ends. The flights also separate munitions to prevent propagation between items on opposite sides of the flights, and help reduce the pressure waves caused by a detonation.

The upgrade of the furnaces required several major additions to the existing system. Under RCRA requirements the stack emissions must be sampled to demonstrate that 99.99% of the principal organic hazardous constituents (POHCs) are destroyed by the system. The system must monitor the stack emissions to verify compliance with the POHC limits on a continuous basis. The data from the continuous monitoring of CO and O2 is also used to control the system by reducing or stopping feed if preset limits are reached. A system to control the feed rate to the furnace is required which will prevent exceeding the feed rates set in the Part B permit and which will stop feed to the incinerator should an upset condition or equipment failure occur. The particulate discharge to the atmosphere can not exceed .08 grains per cubic foot. The equipment includes a shroud over the retort and feed conveyors to contain fugitive emissions so there are no uncontrolled discharges to the atmosphere. The control system compares all sensor generated data with established limits and controls temperatures, pressures and feed rates to maintain compliance with the permit conditions.

To comply with the requirement for destruction of hazardous constituents an afterburner was added as a secondary combustion chamber to complete combustion. This system has the capability to elevate the temperature of the exhaust gas from 450o F to 2000o F. The minimum residence time in the afterburner is 1 second at 1800o F. The operating temperature of the system to achieve complete combustion will generally be 1200o F to 1400o F except when higher temperatures are needed to destroy more problematic organics. At these temperature all hazardous material should be destroyed to the 99.99% or higher level.

To reduce the exhaust gas temperatures, protect the baghouse and prevent fires caused by the elevated temperatures two air-to-air heat exchangers or gas coolers were installed in the system. The largest of these units can cool the exhaust gas from 2000o F to 850o F. The second unit cools the air from 850o F to 350o F. Additional cooling occurs in the ducting between equipment so that the temperature entering the baghouse is between 250o F and 300o F.

The existing APE 1236 furnace includes a baghouse and cyclone. The cyclone is used to remove large particles. The baghouse, which is either a 100 or 144 bag unit, provides fine particle filtration of the exhaust gas. These pieces of equipment are used to comply with the requirement for particulate discharge to the atmosphere.

The ducting connecting the baghouse to the exhaust stack includes a bypass. The bypass is used during start up to allow the system to reach the preset operating temperature before the exhaust gas is sent through the baghouse. This is required to prevent condensation on the baghouse which reduces the efficiency and effectiveness of the filters.

The draft fan was increased from a 30 hp to a 50 hp unit capable of producing 6700 scfm at 30 inches of water column. The fan size was increased to account for the additional pressure losses in the system resulting from the afterburner, gas coolers and shrouding around the furnace and feed end conveyor.

A Beckman gas monitoring unit was purchased which measures the level of CO and O2 in the stack emissions. The CO level is used as an indicator of complete combustion. CO is used due to the extreme difficulty in measuring the actual level of hazardous material in the exhaust. The allowable limit for CO is 100 parts per million measured as a 1 hour rolling average updated every minute. The previous 59 readings are added to the current reading, averaged and value used to determine the CO level. The O2 is used to indicate if dilution air is being added to the system. The CO level is corrected to 7% O2 dry measurement.

A stack velocity measurement device is included in the controls to record the velocity of the exhaust gas up the stack. This equipment measures pressure and temperature and provides to the computer the data needed to calculate the stack gas velocity.

To prevent exceeding the feed rates for a particular munition a waste feed rate monitoring system was installed in the control room. This is a unit incorporating an explosion proof scale upon which every item to be fed to the furnace is placed. The item or items are weighed and compared to a data table which contains the permissible weight of that item per unit of time. If the weight is equal to or less than the allowable limit the item is loaded to the feed conveyor. If the limit is exceeded the operator must remove units until the weight is below the allowable limit. If a problem with the operation of the system occurs, such as failure of a component or exceeding the emission limits, the feed conveyor stops and the waste feed rate monitor prevents feeding of additional items to the furnace until the problem is corrected.

A dual conveyor arrangement was installed in the system at the direction of the EPA. In discussions with the EPA the decision was made that emptying the feed conveyor in an upset condition before correcting the problem was environmentally unacceptable. On the other hand, it was considered to unsafe to stop the conveyor with munitions on it since munitions may be stopped at the entrance to the incinerator feed chute where they could be heated to the point of burning or detonating outside the confinement of the retort sections. The dual conveyor arrangement allows stopping feed to the furnace except for the items which are on the short conveyor. The short conveyor will continue to run and load these items into the furnace to prevent an unsafe situation.

The retort and feed conveyors are shrouded to control fugitive emissions which occur when the pressure inside the furnace goes positive. This happens when a munition detonates or the feed rate exceeds the capacity of the furnace. The shrouds capture these emissions until the balance in the retort is restored and the emissions can be pulled back into the furnace.

The last major component installed in the upgraded system is a new control system. The control system consists of a Honeywell PLC which controls operation of the equipment, an IBM computer which houses the data base for the munitions, records the data from the system sensors and provides an interface to the data recording devices, which are a strip chart recorder and printer. A color monitor allows the operator to interface with the computer and visually observe the condition of the system during operation.

The control system provides both automatic and manual start up capability as well as local start up of components for maintenance. The lights on the control panel indicate the current status of system components and alarm lights if a problem should occur. By observing the control panel, the operator has the ability to determine the status of the system and detect any problems that may exist.

A typical operation would be as follows. The operator enters the munition identification code for the item to be processed. The code is compared to the information stored in the data base and a screen shows the operator which item has been identified and the operating parameters for that item. The operator then verifies that the correct munition has been selected. The operator then pushes the green system start button and the PLC automatically starts the equipment in the programmed sequence. Information such as temperatures, rotation speed, pressures and other system information is sent to the controlling devices. The system continues through start up until all preset operating conditions are met and the operator is then permitted to start feed to the furnace. At the end of the day the operator simply pushes the stop button and the system is shut down in the programmed sequence.

Problems with the project include defining the munitions which will be included in the data base. Each site processes some but rarely all of the approved feed list items and many sites have a unique item or two. In addition, the regulations are constantly being updated. What may have achieved compliance when the project started may not meet existing standards when the system is put into operation. For example, regulations determining what constitutes a hazardous waste are being constantly changed and class 1.4 munitions which were not classified as hazardous waste may soon be. The particulate standards have been revised and a new limit will soon go into effect.

States are allowed to set their own standards and the standards and interpretation of standards are not consistent state to state. For example, some states allow the upgrade without an approved permit while other states will not allow construction without a permit in place. All this creates a climate in which determining exact design requirements is very difficult. The decision was made early in the project to make all systems the same initially and to make modifications as required by particular site problems.

The final issue is the part B permit. This permit, which allows the furnace to be used as a hazardous waste incinerator, is issued to the site by the state or federal EPA depending on who has primacy. The permit sets forth the conditions which must be met to comply with environmental regulations. The Code of Federal Regulations or CFR 40, which is the controlling document for hazardous waste, also includes "omnibus authority". This permits the regulators to implement any policy which they feel is necessary to protect the health and safety of the environment. This is in effect an open ended authority to develop any policies and regulations, in addition to those specifically listed in RCRA, which the regulator feels are necessary.

Much of the permit focuses on records for the material which is processed in the furnace. Much of the data needed for the record keeping requirements is logged by the control system and will be used to demonstrate compliance with the permit standards. This data includes operating parameters, feed rates and logging any upset conditions which occur.

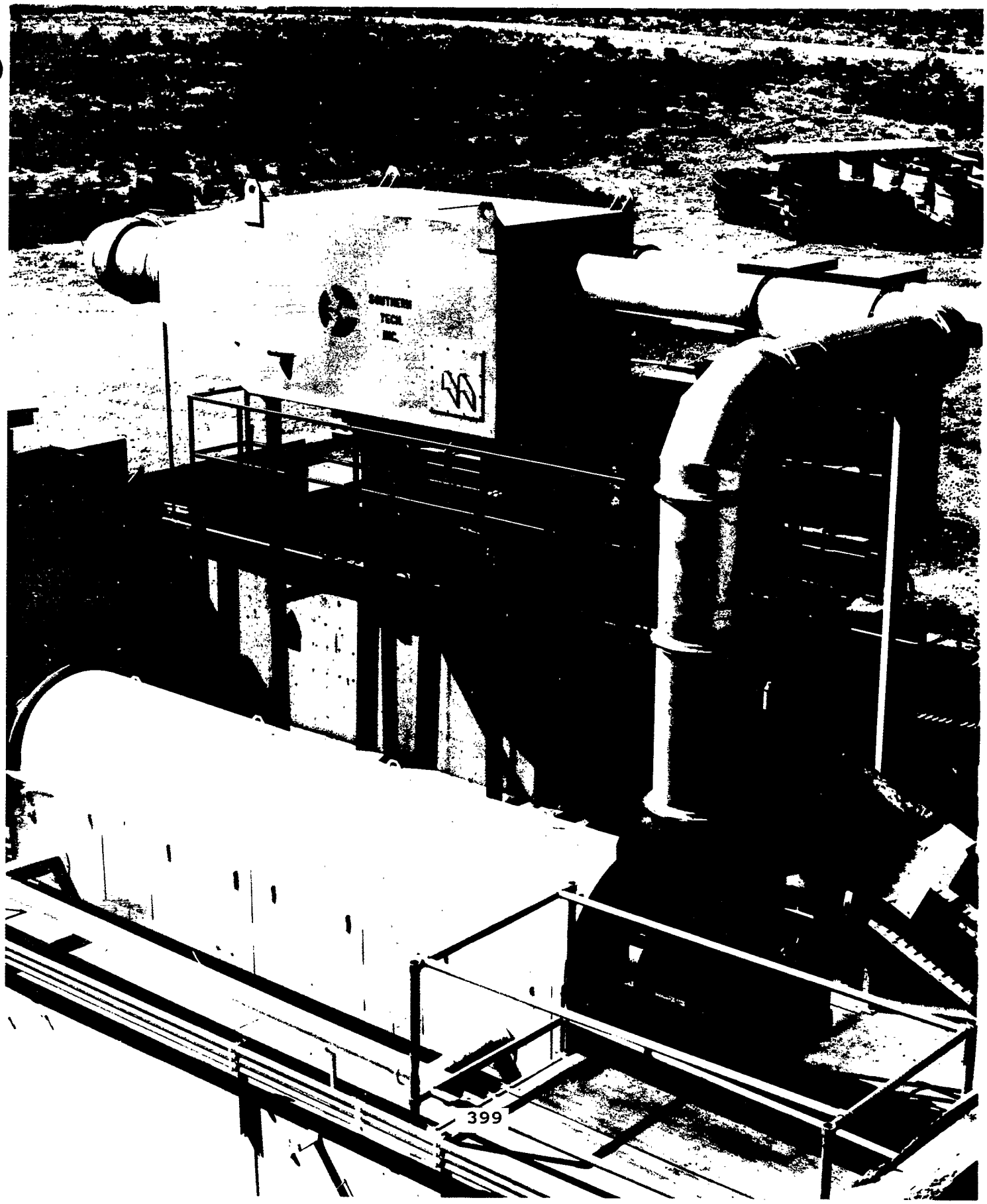
Trial burns to measure the level of pollution during furnace operation are being scheduled for the sites . The trial burn is used to demonstrate that the furnace can achieve the destruction of hazardous waste and protect the environment. The data obtained during the trial burn will be used by the state to determine and set forth the permit conditions under which the furnace must be operated.

In conclusion, the upgrade is currently proceeding on 9 sites with the specification for 4 additional sites being prepared and other sites are under review. The project has gone well in most cases. There have been some design changes which are being incorporated at all sites. The equipment has been operated successfully at Tooele, Iowa, and Lake City. There is still some work to be done to complete the systems and pass a trail burn. Several sites should be complete in the near future. Compliance with environmental regulations is a priority and this system upgrade will bring the furnaces in line with the standards in effect today.

Incineration of munitions appears to be the acceptable method of the future. Open burn / open detonation is being more severely restricted all the time and may soon be outlawed. In this light the furnaces will provide the only approved method of disposing of munitions.

Difficulties will occur in complying with regulations. The regulations will become more restrictive and harder to achieve. There will be an increase in the types of items which will be regulated and the record keeping to needed to satisfy the regulators that environmental laws are being observed. There will be an increase in the requirements to demonstrate that burning munitions is environmentally safe. Waste characterization will be an increasing burden as the restricted items list grows. The characterization of munitions is very time consuming and expensive. It took nearly 8 years to characterize the explosives and propellants now listed in the permit applications. No serious work has been done on characterizing the metal components of munitions. This may well become the next major problem facing the sites which incinerate munitions due to the difficulty in defining the exact make up of the metal components.

It appears that future disposal of munitions will produce many challenges and provide opportunity to develop new methods and technology for safe and environmentally sound disposal of these items.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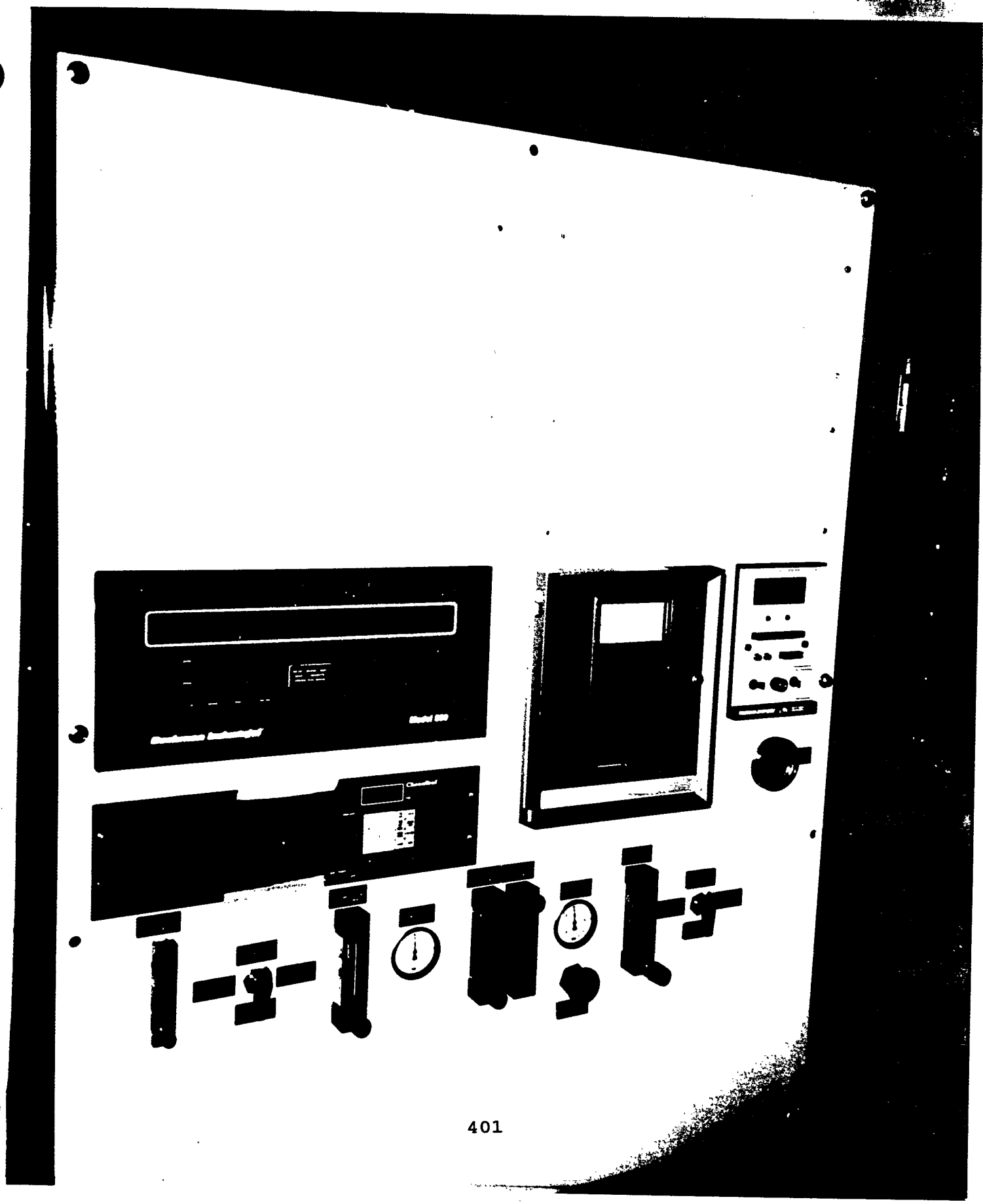

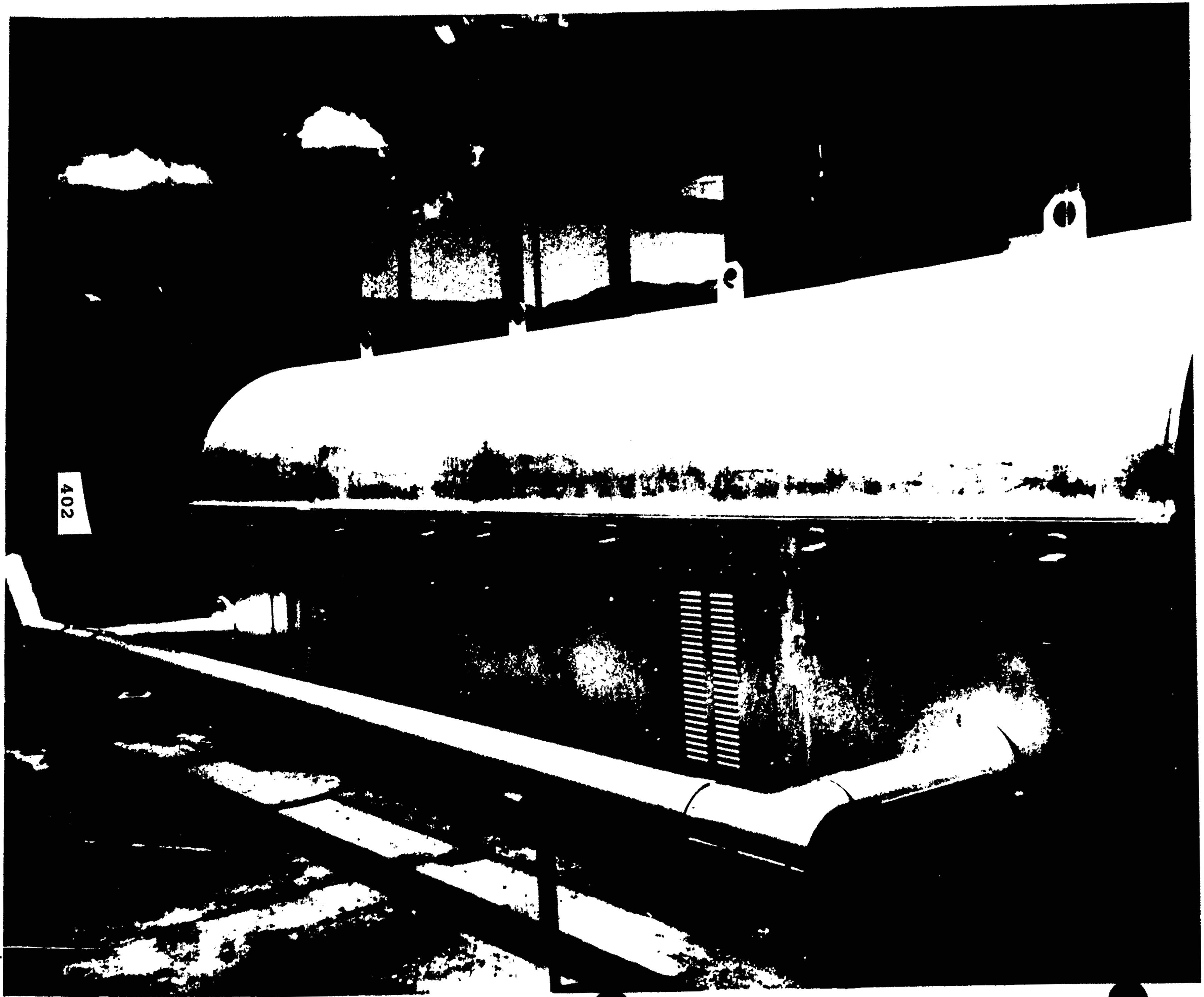
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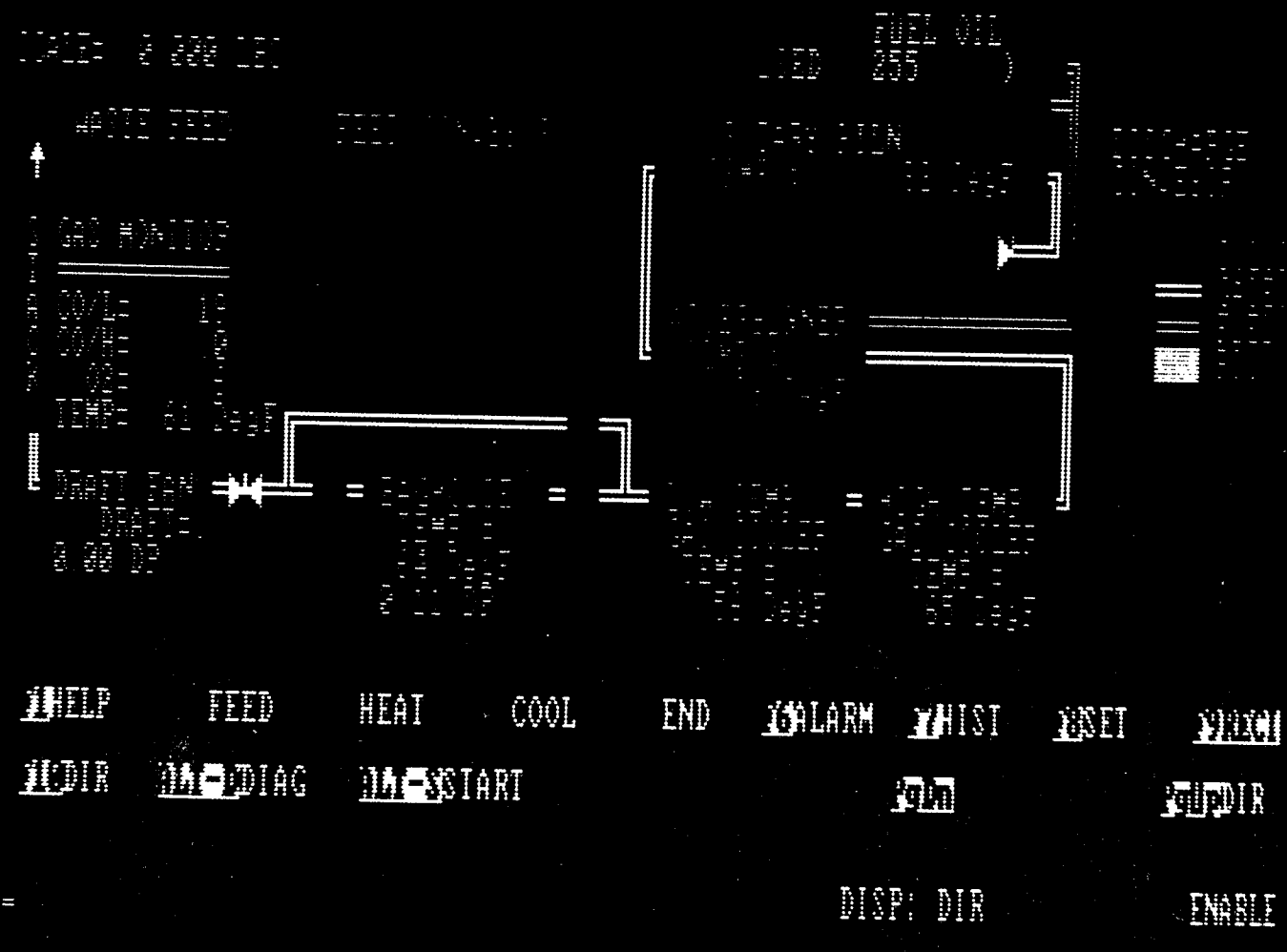
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